



Solution

NDBI007: Practical class 3



Exercise 3.3 (Solution)

❖ Select class storage

$$h(49,7) = 49 \bmod 7 = 0$$

❖ We can expand the class storage at the end of the primary file

❖ I.e., $p = 3, r = 3$

❖ Then we need to select proper i

$$h_0(14,3) = (14 > > 0) \bmod 3 = 14 \bmod 3 = 2$$

$$h_0(21,3) = (21 > > 0) \bmod 3 = 21 \bmod 3 = 0$$

$$h_0(49,3) = (49 > > 0) \bmod 3 = 49 \bmod 3 = 1$$

position	i	r	p	key	value
0	0	3	3	0	14
1				1	10
2				2	17
3	0	2	1	3	21
4				4	28
5				5	14
6				6	
				7	

Exercise 3.4 (Solution)

❖ Select class storage

$$h(63,7) = 63 \bmod 7 = 0$$

❖ We can expand the class storage at the end of the primary file, i.e., $p = 3, r = 4$

❖ Then we need to select proper i

$(14 \gg 0) \bmod 4 = 2 \quad (21 \gg 0) \bmod 4 = \mathbf{1} \quad (49 \gg 0) \bmod 4 = \mathbf{1} \quad (63 \gg 0) \bmod 4 = 3$
 $(14 \gg 1) \bmod 4 = \mathbf{3} \quad (21 \gg 1) \bmod 4 = 2 \quad (49 \gg 1) \bmod 4 = 0 \quad (63 \gg 1) \bmod 4 = \mathbf{3}$
 $(14 \gg 2) \bmod 4 = \mathbf{3} \quad (21 \gg 2) \bmod 4 = 1 \quad (49 \gg 2) \bmod 4 = 0 \quad (63 \gg 2) \bmod 4 = \mathbf{3}$
 $(14 \gg 3) \bmod 4 = 1 \quad (21 \gg 3) \bmod 4 = \mathbf{2} \quad (49 \gg 3) \bmod 4 = \mathbf{2} \quad (63 \gg 3) \bmod 4 = 3$
 $(14 \gg 4) \bmod 4 = 0 \quad (21 \gg 4) \bmod 4 = 1 \quad (49 \gg 4) \bmod 4 = \mathbf{3} \quad (63 \gg 4) \bmod 4 = \mathbf{3}$
 $(14 \gg 5) \bmod 4 = \mathbf{0} \quad (21 \gg 5) \bmod 4 = \mathbf{0} \quad (49 \gg 5) \bmod 4 = \mathbf{1} \quad (63 \gg 5) \bmod 4 = \mathbf{1}$
 $(14 \gg 6) \bmod 4 = \mathbf{0} \quad (21 \gg 6) \bmod 4 = \mathbf{0} \quad (49 \gg 6) \bmod 4 = \mathbf{0} \quad (63 \gg 6) \bmod 4 = \mathbf{0}$

❖ For every $i > 5$ we always get a collision

❖ In such case, we increase r by one and again we need to select proper i

$(14 \gg 0) \bmod 5 = \mathbf{4} \quad (21 \gg 0) \bmod 5 = 1 \quad (49 \gg 0) \bmod 5 = \mathbf{4} \quad (63 \gg 0) \bmod 5 = 3$
 $(14 \gg 1) \bmod 5 = \mathbf{2} \quad (21 \gg 1) \bmod 5 = \mathbf{0} \quad (49 \gg 1) \bmod 5 = \mathbf{4} \quad (63 \gg 1) \bmod 5 = \mathbf{1}$

position	i	r	p	key	value
0	0	5	3	0	14
1				1	10
2				2	17
3	0	2	1	3	21
4				4	63
5				5	14
6				6	
				7	49
				...	

Exercise 3.7 (Solution)

$h_0(41) = 41 \bmod 5 = 1 \quad s_0(41) = (41 > 0) \bmod 7 = 41 \bmod 7 = 6 \sim 110_2$

- ❖ Page number 1 is full and the highest signature belongs to record 41
 - ❖ Therefore, we upgrade separator to 110_2 and reinsert record 41

$h_0(41) = 41 \bmod 5 = 1 \quad s_0(41) = (41 > 0) \bmod 7 = 41 \bmod 7 = 6 \sim 110_2$

- ❖ Again, page number 1 but this time 41 has too big signature
 - ❖ Hence we fail to insert (i is increased) and we try to insert 41 again

❖ $h_1(41) = (41 + 1) \bmod 5 = 2 \quad s_1(41) = (41 > 1) \bmod 7 = 6 \sim 110_2$

- ❖ Page number 2 is also full and again 41 has the biggest signature
 - ❖ We update page separator and reinsert again

❖ $h_2(41) = (41 + 2) \bmod 5 = 3 \quad s_2(41) = (41 > 2) \bmod 7 = 3 \sim 011_2$

0	10	40	30
110	011	101	010
1	51	61	20
110	010	101	011
2	32	37	42
110	100	010	000
3	41		
111	011		
4			
111			

Exercise 3.8 (Solution)

$$h_0(67) = 67 \bmod 5 = 2 \quad s_0(67) = (67 > 0) \bmod 7 = 67 \bmod 7 = 4 \sim 100_2$$

- ❖ We try to reinsert record 67 into page 2
 - ❖ The page 2 is full, therefore we have to split the page
 - ❖ This time, we have two values having the highest signature, i.e., 32 and 67
 - ❖ Hence we update the page separator and reinsert both values

$$h_1(32) = (32 + 1) \bmod 5 = 3 \quad s_1(32) = (32 > 1) \bmod 7 = 5 \sim 101_2$$

$$h_1(67) = (67 + 1) \bmod 5 = 3 \quad s_1(67) = (67 > 1) \bmod 7 = 2 \sim 010_2$$

0	10	40	30
110	011	101	010
1	51	61	20
110	010	101	011
2		37	42
100		010	000
3	41	32	67
111	011	101	10
4			
111			